SCIENCE

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ADDRESS OF THE PRESIDENT OF THE ROYAL SOCIETY[1]

By Sir HENRY DALE, G.B.E.

THE council's report, covering the period of a year ending September 30, makes mention of the scientific mission to Australia now completed by our Foreign Secretary, Sir Henry Tizard, whom we are glad to welcome on his return. The report does not extend, however, to the later departure for India of our secretary, Professor A. V. Hill. The Government of India, through the Secretary of State, asked the Royal Society to depute a distinguished scientist to visit India for consultation on scientific matters, and in particular to advise on scientific and industrial research in relation to measures of post-war reconstruction and on the coordination of such plans in India with corresponding activities here and elsewhere. We felt that our proper response to such an invitation was to let India have a man of the highest qualification from our own fellowship; and I feel confident that the fellows will approve of our action in releasing for the necessary period our senior secretary, who is also one of our research professors, to enable him to accept this important mission. I ask you, further, to send from this meeting a message to Professor Hill of good wishes for the full success of his undertaking and of hope that one of its results will be to strengthen the bonds of understanding and true comradeship between our Indian colleagues and the men of science of this country. In that connection I ought further to report to you a step which I have taken, with the approval of the council, and for which I have not found any precedent in our records. It was brought to my notice that of the six distinguished Indian men of science who are at present on the roll of our fellows only two have hitherto been able to present themselves here in order to subscribe the obligation in our charter book and to be admitted according to the statute. It seems certain that the war will create still further difficulty and delay for the attendance here of the other four, and I have accordingly

[1] Delivered at the 281st anniversary meeting, November 30, 1943.

commissioned Professor Hill to take with him to India a sheet of suitable parchment on which the fellows' obligation is inscribed, and on which signatures can be taken for eventual incorporation in the appropriate page of the charter book, unless opportunity should earlier present itself for our colleagues to visit us here and sign directly in the book itself. I have nominated Professor Hill as a vice-president and, under Statute 42, have deputed him to perform on my behalf our simple ceremony of admission. We hope that he may be able to do this at the meeting of the Indian Science Congress. It seems fitting to take this unusual opportunity thus to complete the reception into the circle of our fellowship of all the Indian men of science whom the society has elected. During Professor Hill's absence the council have invited Dr. Salisbury to act as biological secretary, and we are grateful to him for consenting to give us this help in the emergency.

Last year we devoted this anniversary meeting to a simple celebration such as the war conditions allowed of the three hundredth anniversary of the birth of Isaac Newton. We have noted with appreciative interest that other countries also marked the tercentenary year by paying homage to our Newton's memory. Particular mention is due to the commemorative meetings held, under the tremendous stress of war, not only by the Moscow Academy of Sciences, but also in a number of other scientific centers of Soviet Russia, one as far away as Novo-Sibirsk. The council's report mentions the gift which we have sent to the Soviet Academy of Sciences of Moscow, in recognition of this union with our colleagues of Soviet Russia in commemorating one of the greatest scientific achievements of all time, as in the present devotion of all that science can give, in both our countries, to the winning of this war for freedom.

Not since 1941 have I addressed the society from this chair, at its anniversary meeting, according to regular custom. Only a week after we met here in 1941, the United States of America had become our ally; less than a year later came a turning-point of the war, with Stalingrad and El Alamein; and now the end seems no longer to be in doubt, though we can not tell how long it may be in coming. I think that it is proper now to claim for science its due share in the achievements which have created the present prospect, in such vivid contrast with that of two years ago. Science in the countries of our great alliance has been devoted without reserve during these two years to the winning of the war; in this country it had been so already for the two years which preceded them. No longer are the allies straining now to overtake a lead gained by the enemy in years of stealthy preparation; the lead is rather on our side. If such things could be weighed and measured, I believe that we should find the alliance to be as far ahead of our enemy in the present volume of our united war researches, and in the brain power of the highest class now concentrated upon them, as in the more readily ponderable output of war material by our industries. And no more than our armed forces or our factories can science afford to relax or to divide its effort until the total victory has been won, without which we can have no faith in the world's future. The increasing certainty of the end, however, imposes upon us with a growing urgency the duty of looking also to that future and to the part which science must play in the nation and the world when peace returns.

From different influential quarters, as from the Parliamentary and Scientific Committee and from the Federation of British Industries, we have had important pronouncements on the urgent need for national enterprise and national spending on higher education in science and technology, and on the encouragement of research in the applications of science to industry. No body of scientific men will need arguments to convince them that we must think in such matters on a scale, not merely larger, but of a higher order than any with which we have hitherto been familiar. Before the last war Germany had led the world in such development, and between the wars we saw the United States of America move swiftly into the lead. Soviet Russia, starting with a background almost bare of such organization, and with a population largely illiterate, but with leaders having a clear vision of what science was to mean for the modern world, has now shown us what a miracle of scientific education and technical development can be wrought in a quarter of a century. Can it be doubted that another great ally, China, when freed from her long agony of war, will rapidly establish her claim also to high rank among the great nations of the world now in the making? Surely it is clear that, if we are to hold our proper place alongside such great new civilizations, built right from their foundations on modern science, we must ourselves face the problem of giving to science its proper place in the fabric of our own, without grudging or hesitation.

We of the Royal Society shall certainly give enthusiastic endorsement to any movement in that direction. From its beginning to the present day our society has always taken a lively interest in the applications of science to the general enrichment of human life, and the enlargement of the means of human happiness. One of the expressed objects of the extension, in recent years, of the number annually elected into our fellowship, was the maintenance of that interest, under the growing pressure for recognition of achievements in the more fundamental and academic ranges of science. We shall certainly welcome, then, and join

in advocating a great expansion of the nation's support of applied science, whether through the Government's research councils concerned with researches bearing on industry, medicine and agriculture, or through departments concerned with the uses of science for defensive preparations in peace time and for other national interests, or with the training of recruits for research by grants of public money to the universities. I think that it can properly be claimed that we knew here, even before the belief attracted a wider support and conviction, that a modern nation, as certainly as a well-organized modern industry, depends for success upon generous and far-seeing expenditure on scientific research and on the recruitment of first-rate ability to its service, and risks failure and disaster by parsimony and a narrow vision of its responsibilities in these directions.

The response of our national scientific reserves to the demands of war might suggest that our national deficiency hitherto has been chiefly in provision for the applications of science, and that fundamental researches in this country have lacked less in opportunity and encouragement. Here too, however, if we make comparison with other countries, I think that we shall be obliged to conclude that our discoverers, as great as any, in a world era of great discovery, have often had to do their work in spite of a paucity of equipment and accommodation which would hardly have been conceivable elsewhere. That is a difficulty and a disparity which, unless some action is taken, will certainly increase with the growing demands of fundamental researches for elaborate and costly items of equipment. Recent discoveries have made such available and necessary, at a rate which the war-time concentration of research will even have accelerated. Money to procure and to install it will become ever more essential to work on the general front of scientific progress. The society's council, having considered a memorandum by certain of its fellows on the prospective needs of fundamental researches in physics, have already appointed a committee to consider the position in detail. It seems unlikely that other departments of fundamental science, when news of this decision reaches their representatives, will wish the society to assume that the needs of physics, even if more obvious than some others, are unique in their importance and urgency. With so many interests and authorities now directly concerned for applied science, we can hardly doubt, indeed, that it is to-day a primary duty and mission of the Royal Society, as of the related societies having more special and restricted aims in science, to aid and to encourage researches which seek the advancement of knowledge without immediate reference to its use, though with a clear conviction that such progress is often a necessary condition of practical advance, or even the most direct way towards it. Care for the practical fruits of the tree of knowledge was never, indeed, so urgent as to-day; but the tree will wither unless we take care also that the roots have nourishment and room for spreading.

The mention of this last necessity brings me to the problem of the need of the Royal Society, and the more pressing need of one, at least, of our neighbor societies here, for accommodation more worthy of their national importance. The matter has more than once been under discussion in the past, and has recently been a matter of renewed concern to the society's officers. With the efficient help of our assistant secretary, Mr. Griffith Davies, we have been making, in this connection, a survey of the records dealing with the different homes of the Royal Society, from its foundation down to recent years. I think that on another occasion, when more time is available, the society may like to hear a review in greater detail of this aspect of our history, which has many points of interest. To-day the mention of a few of these must suffice.

Early in our career the interest of the Crown in the society, and perhaps a recognition of a duty to provide accommodation for it, were signified by King Charles the Second's grant of Chelsea College and its estates, as set forth in our third charter of 1669. The property proved, alas, for various reasons, to be much more a burden than an asset, and Christopher Wren, in 1682, with the council's approval and recorded gratitude, sold it back to the King for £1,300. Meanwhile an opportunity for the society to acquire a house of its own, built to the designs of Hooke and Wren, on a piece of land granted by Henry Howard from the grounds of Arundel House, had not become effective. The society, therefore, remained for fifty years from its foundation a tenant of rooms in Gresham College, till in 1710, when Isaac Newton was president, it acquired the house in Crane Court, off Fleet Street, which was its home for another sixty-eight years. In 1778, thanks to the personal interest in our affairs of King George III, the friend of our great president of those days, Sir Joseph Banks, the society was granted quarters in Somerset House. Therewith the obligation of the state to provide us with housing was for the first time definitely accepted, "in generous recognition by the Sovereign of the services which science had rendered to the state," as Banks stated in his address of 1780. The records show that the accommodation in Somerset House was regarded from the first as inadequate, even though our requirements had been reduced by the transfer of our "Repository of Rarities" to the British Museum. The rooms, on the other hand, can be seen from prints

of the period to have had a pleasant dignity, and the society remained in them for nearly eighty years.

Towards the middle of the nineteenth century, a movement arose to secure new and better accommodation for the Royal Society, and at the same time for the other principal scientific societies then existing—the Linnaean, Geological, Astronomical and Chemical Societies. As early as 1847 a memorandum was presented to our council by the newly founded Philosophical Club, a more seriously minded secession from, or rival to, the Royal Society Club of those days, formed under the same influences as those which had just carried the revised method of electing our fellows. The club presented proposals for bringing the major scientific societies under one roof, centralizing and coordinating their libraries without any attempt at fusion, providing three or four meeting rooms of different sizes, for use by the societies in common and in turn, and, in general, making better provision for the interests common to all without any impairment of their independence in rules, traditions, procedures or property. When those of us who have been considering present-day needs look at this memorandum, presented in 1852, we can not but admire the foresight and wisdom of our mid-Victorian predecessors.

An opportunity of housing the scientific societies thus, as a community of cooperative but substantially independent units, was actually presented in the same year, 1852, by the offer of accommodation in new buildings then being planned on the estate at Kensington Gore, acquired with the proceeds of the 1851 Exhibition. We begin to see the benevolent interest of the Prince Consort in our concerns. Kensington Gore, we must remember, in those days of horse transport, was still on the rural margin of the suburbs; and, in gratefully declining the offer, the Royal Society and its associates urged upon the Government the desirability of housing the scientific societies centrally and, if possible, under a single roof. The acquisition by the Government, some years earlier, of Burlington House and its grounds, extending from the Piccadilly frontage through to the street which is now named Burlington Gardens, seemed, indeed, to have provided the ideal opportunity for giving effect to such a plan. The Prince Consort, with a vision of the future meaning of science far in advance of his time, privately urged the five scientific societies to press their claim to the site. It had been understood, indeed, that the primary intention of the Government in buying Burlington House had been to provide accommodation for the learned societies. Lord Wrottesley, then our president, personally canvassed the Government, making it clear "that the desire of the chartered societies for juxtaposition and for the Burlington House site was unabated." Failing that, he indicated, they would be glad to be lodged in the buildings then occupied by the Royal Academy, that is, in what is now the National Gallery. The danger of a rival claim had become clear, and had, indeed, been mentioned to the Royal Society by the Prince Consort. It appears that the Government had already made some kind of commitment to the Royal Academy, so far as the mansion of Burlington House was concerned. It would take much too long to discuss even what is known of the rival lobbyings of those days. It must suffice for this occasion to recall the results, and to lament the fact that a magnificent opportunity was lost, which would have given London a scientific center worthy of the nation's achievement. We can not blame our predecessors, who probably did all that was possible; nor can we grudge their success to our friends of the Royal Academy, who are in no way to blame for taking what was offered to them. If the Government, indeed, had then used Burlington House and its grounds to discharge only these two, of the obligations to which they were to some degree committed, the needs both of the scientific societies and of the Royal Academy could still have been handsomely met, and adequate scope for future development could have been insured to both. The mansion itself with the wings of this front courtyard, already scheduled for rebuilding, could, for example, have been allotted to one, while the other of the two claimants could have had a new building, with frontage at the north end of the gardens, and ample space for extension southwards over them, to meet increasing needs and new developments. The Government, however, used Burlington House first to satisfy a third obligation which it had accepted, to house the University of London, then only a degree-giving body requiring space chiefly for the periodical examination of large numbers of candidates. Then in 1858, the continued pressure of the scientific societies and the Government's own desire to recover the rooms in Somerset House, led them to offer the use of Burlington House to the Royal Society, subject to the condition that for the time, and pending rebuilding on the sites round this courtyard, the Linnaean and Chemical Societies should be accommodated with us in the mansion, and that the University of London should still be able to use the large rooms in it for examinations. It is curious to reflect that this temporary arrangement gave to the Royal Society and its associates their only opportunity to this day, even to share the use of a room suitable for a meeting of more than very modest dimensions.

In old Burlington House, then, we were established, and were to remain there with the Chemical and Lin-

naean Societies for some fifteen years; and an appearance of stability had at first been given to our occupancy by the mention of plans to build a new examination hall for the University of London on the western side of this quadrangle, and to allow the Royal Society to use this also for large meetings and for its gallery of portraits. Two later developments, however, dispelled any such hopes. In 1867 evidence came to the society, first through a statement in *The Times*, that the Government had decided, after all, to give the Royal Academy a permanent lease of Burlington House and the right to extend northwards by building over its gardens. At about the same time, and presumably in fulfilment of another commitment, the large building which now fronts on to Burlington Gardens was begun, to accommodate the University of London and its examinations, and was opened by Queen Victoria in 1870.

The scientific societies were not, indeed, to be homeless; but the only possibility now left was to accommodate them in the buildings planned to be erected round this front courtyard, where they have been ever since. The total space thus offered did, indeed, allow more room to each of the societies than it had previously enjoyed, even after the Society of Antiquaries, at the Royal Society's instance, had been included in the scheme. But the space now available could not easily be planned for the sharing of meeting rooms and general facilities, or for a central federation of the libraries, or for any of the features of the earlier plan which would have enabled the societies to function as independent members of a real scientific community. The scheme had an even more fatal defect. The plans were made on the assumption that the societies existing in the 1860's, with their respective dimensions and requirements at that date, would provide a pattern of the needs of science for all time, or at least for the life of buildings designed to mid-Victorian standards of permanence. Each of these societies, therefore, with the approval of our own we must admit, presented its separate claim and had it embodied in the solidity of the buildings we still inhabit, filling the available space completely and precluding any later expansion, rearrangement, or new admission to the circle thus finally closed. Societies which have changed but little in numbers or activities may have had little reason, even yet, to complain of the accommodation which they then acquired. For others, the allotment which had been regarded then as satisfying future needs for half a century at least, became obviously inadequate very much earlier.

In 1900 came news that the large building on the Burlington Gardens frontage was to be vacated by London University, and tentative inquiry was immediately made as to the possibility of allotting it to the Royal Society, on the ground that "the present rooms occupied by the society were rapidly becoming inadequate." The Government, however, had already decided to transfer the building to their Civil Service Commissioners, and it has continued to be dedicated to its original use for large-scale examinations, save for the later assignment of certain rooms in it to our much younger sister, the British Academy. It will be noted that the Royal Society was finding its quarters here inadequate as early as 1900, twenty-seven years after it entered them, and before there was even any prospect of the great expansion of its responsibilities and activities in recent years. Our accommodation is still the same to-day, after seventy years. Our walls can not find room to hang our important collection of scientific portraits, and our great library is badly overcrowded, even though we have parted with some of it to give better housing, for a time, to the remainder; and it continues, of course, to grow. Library pressure, in fact, is felt to varying degrees by all the societies here; and I think that it is still true, as some of our predecessors saw already in the 1850's, that no scheme will be able to deal with this problem efficiently, and to meet modern needs without disturbing historic associations, which does not include some kind of central coordination of libraries. The lack of a lecture or conference room, available in common for larger meetings, and well equipped with modern resources for projection and demonstration, is another acutely felt need. There are greater needs and anomalies, however, than any of these common ones. Of all the societies here the Chemical Society, which was originally satisfied with the poorest allotment of rooms, has undergone the greatest expansion. In the 1860's it had a membership of some 450; it now has about 5,000. Its library, of great importance to all workers in chemistry, whether fundamental or applied, has so burst the bounds of its accommodation, that a part of it is deposited in the crypt of a neighboring church; and the Chemical Society's meeting room is in every way unsuitable, and inadequate to the meanest conception of the regular needs of a society of its standing and numbers. Apparently our predecessors of the 1870's did not see much future for chemistry. On the same evidence, they did not foresee any future for physics at all. The Physical Society did not then exist; by the time it was born there was no room for its admission, and the State has never offered it a home. The same is true of other societies formed later to deal with functional aspects of biology and other new fields of knowledge. For most of their meetings these newer societies use and need the facilities available in academic and research institutions.

A national center of science, however, should be capable of progressive adjustment to changing needs, and we ought to be able to make new admissions, on a varying scale of allotment, to the central community of societies.

What, then, should we be doing to deal with the situation? Actions and decisions long past have imposed it upon us, and regrets and repinings over an opportunity lost more than seventy years ago will not help us to-day. We must admit, too, that our present quarters, with all their defects of elasticity, have provided a combination of central position with freedom from noise of traffic which might be hard to find again. Let me say, then, that the Royal Society's officers, having consulted with the officers of other societies here, and particularly of those whose needs are urgent or whose interests might be directly concerned, have not yet abandoned the attempt to find a solution which would not involve the removal of any from the Burlington House estate. If we fail in that direction—and there is no ground for optimism—the problem will remain, and the time is not one for neglect or postponement of action. On all hands we hear talk of reconstruction and see plans for the rebuilding of London. We can not expect another Christopher Wren—one of our original fellows and a leader in the science of his day; London missed that opportunity. It is natural and proper for the plans now being presented to make spacious and impressive provision in the new London for opera, drama, music and all the fine arts; and we shall surely join in a general welcome to any practicable scheme which can open the doors more widely to such cultural privileges, and enhance their dignity and worth in the eyes of London and of the nation. But I do not think that we must stand by and allow the claims of science again to go by default. A fear of overstatement, a passion for critical accuracy which is a part of the very spirit of science, may make us reluctant advocates. If necessary, however, we must be ready to remind all who may be concerned of the part which the British scientific effort has played, in making it possible now to plan at all, with confidence, for our own civic and national reconstruction. But for science, we may remind them, the very different plans which our enemies were so recently making for our future might already be taking effect. I have no doubt that the claim will be handsomely admitted; but we ought not to be too easily appeased with compliments and oratorical bouquets. The nation's opportunity, when peace returns, of enjoying the arts and the amenities of life will be dependent on its standards of health and prosperity, and these, in turn, ever more directly on science and its applications, as certainly as these are still needed to secure our national survival and victory in this war.

This ancient Royal Society of London, and those societies which have grown from it and round it in later years, constitute a scientific organism which is a national and imperial heritage, second to none in the world's esteem. Here are the roots of the spreading tree of science and technology, which should form a major component of our national contribution to the new world now in the making. Seventy years ago these roots were given only enough soil for the replanting then undertaken; they have long been badly pot-bound, and some parts of the root systems are threatened with strangulation, while others have appeared outside the pot. We can properly claim, I think, that the progressive needs of our scientific societies shall be given early consideration, in any new allotment which plans for reconstruction may allow. We ought to have a scientific center permitting them to coordinate their activities with economy, and giving room for change, expansion and organic growth by budding and division, in accordance with nature's law. I think that we have the further right to expect that the home of science in this capital city will have a dignity symbolizing its value to the nation and the empire, and enabling us to hold up our heads in the company of other countries, whose scientific academies, not more famous than ours, have so long been housed more worthily, and with a more generous recognition of their due place in an enlightened people's scale of cultural values.

OBITUARY

LEO HENDRIK BAEKELAND

When Leo Hendrik Baekeland, honorary professor of chemical engineering, died on February 23, 1944, the faculties of Columbia University lost one of their most distinguished members; and the world lost one of its most eminent industrial chemists.

Dr. Baekeland was born on November 14, 1863, in the old city of Ghent in Belgium. After completing his studies in the Municipal Technical School in that city; he entered the University of Ghent in 1880, where he specialized in the study of chemistry. He immediately demonstrated a superior intellectual ability that enabled him to complete the requirements for the degree of bachelor of science in two years. This was followed by studies for the degree of doctor of science which was awarded maxima cum laude in 1884

t the age of 21, just four years after entering the niversity. In recognition of his genius, his alma nater immediately appointed him to an assistant pro- fessorship and two years later advanced him to asso- iate professor of chemistry. In 1887 in a competi- ion among the alumni of the four Belgian universi- ies, he won first prize which gave him the title, Laureate in Chemistry, a gold medal and a traveling fellowship which changed the whole course of his areer. In 1889, after visiting the principal univer- ities of France, Germany, England and Scotland, the fellowship brought him to the United States, where e met Charles Frederick Chandler, professor of hemistry at Columbia University. Professor Chand- er's keen judgment of human ability quickly recog- ized evidence of genius and determination in the oung Belgian's charming personality. It was largely hrough Professor Chandler's influence that Dr. Baeke- and decided to resign from his position on the fac- lty at the University of Ghent and begin a career in pplied chemistry in the new world, that was to place im in the front rank of humanity's most distinguished enefactors. From this time unitl his death, more than half century, Columbia was a source of inspiration o his restless mind and its well-being the continuous bject of his concern.

Almost from the time he landed on the shores of his dopted country, his inventive genius, bolstered by an nusual grasp of the principles of the basic sciences, egan to produce results that have revolutionized sev- ral great branches of applied science and which have ouched the daily lives and raised the standards of iving of scores of millions of people all over the orld. His invention of Velox photographic paper ut photography into the hands of common people verywhere. In the field of electrochemistry, his de- elopment and perfection of electrolytic cells then in se for the production of chlorine and caustic soda led the establishment of the Hooker Electrochemical ompany and the erection at Niagara Falls of one of e largest and best equipped electrochemical plants the world. This achievement gave the United States firmly established world position in the production f these basic chemicals.

His crowning work, however, was the solving of the ysteries involved in the action of formaldehyde upon henols, giving to the world the new material "bake- te" and establishing a new industry in the field of ructural materials, the synthetic plastics industry. his is one of the most beautiful and masterly scien- fic studies ever recorded and one of the great inven- ons of all time.

The world was quick to recognize his scientific abil- y and his inventive genius. The highest honors at the disposal of nations; of universities of almost every country; of scientific, philosophical and professional societies and of world organizations for the promotion of education, science and industry were gladly con- ferred upon him. Columbia University honored him with the first Chandler Medal Award in 1914 and the first Chandler Lectureship on the occasion of the fiftieth anniversary of the School of Mines and the honorary degree of doctor of science in 1929. In 1917 he was appointed honorary professor of chemical en- gineering to advise and assist the university in devel- oping that branch of engineering education which was rapidly advancing to a foremost place in the engineer- ing schools of the country. For more than a quarter of a century, his wise counsel and brilliant lectures, which were enriched by a vast scientific knowledge and an almost limitless industrial experience, brought to the university a high quality of inspiring instruction and sound research enthusiasm that had much to do with giving Columbia the high reputation it has in chemical and chemical engineering education and re- search throughout the world.

Like all truly great men, Leo Baekeland had high ideals. They guided him in everything he did. He had a rare genius for making them practical. They made him one of the most successful administrators of big business enterprise in modern times. His com- panies, which operated plants in the principal coun- tries of the world, were models of industrial organiza- tion. They were energized by his remarkably vibrant spirit. As a leader of men in the field of scientific en- deavor, he was an outstanding figure of his day. Like most successful men, he had strong convictions which were based on wide experience and on an unusually accurate understanding of human nature. He firmly believed that the scientific method, if practically ap- plied, could be used successfully to solve most of the social, economic and political problems that bedevil mankind.

He loved truth and beauty and sincerity wherever he found them. He loved his fellowmen and all who knew him loved him. He loved his adopted country passionately and served it in high places for many years without compensation. He loved science and its methods. They were the principal motivating factors of his life. He loved Columbia. In its halls, lecture rooms and laboratories where he came to talk and work with members of the faculty and student body, he found an intellectual and spiritual atmosphere that seemed to him to be unusually wholesome, satisfying and unique in universities.

He prized true friendship above almost everything else. His delightful sense of humor, his love of peo-

ple, his engaging informality, his generous nature and charming personality made his company and friends an international legion. To be a guest in his home or to accompany him on his yacht was one of life's choice experiences. No man knew better how to live usefully, triumphantly and beautifully than did Leo Baekeland.

The noble and flaming spirit which characterized our beloved colleague's life and works will illuminate the pathways of thoughtful men in the fields of science and engineering for countless generations.

ARTHUR W. THOMAS
STEPHEN P. BURKE
COLIN G. FINK
WM. D. TURNER
ARTHUR W. HIXSON, *Chairman*

COLUMBIA UNIVERSITY

RECENT DEATHS

ACCORDING to reports in the daily press, Edwin G. Woodward, dean and director of the College of Agriculture of the University of Connecticut, died in the Hartford fire. He was fifty-four years old.

DR. WALTER ALBERT JESSUP, president of the Carnegie Foundation for the Advancement of Teaching since 1934; president of the Carnegie Corporation of New York since 1941, died on July 7 at the age of sixty-six years.

FRED C. PEDERSON, state forester of Virginia, member of the Council of the Society of American Foresters, died on June 25.

WILLIAM H. BARTON, JR., chairman and curator of the Hayden Planetarium of the American Museum of Natural History, died on July 7 at the age of fifty-one years.

THE death at the age of eighty years is announced of Sir Thomas Robert John Ward, first president of the Institution of Engineers of India, fellow of the Royal Geological Society. He was a member of the American Society of Civil Engineers.

ALEXANDER E. CONRADY, professor of optical design at the Imperial College of Science and Technology, London, from 1917 until his retirement in 1931, previously for sixteen years optical designer for the firm of W. Watson and Sons, Ltd., of London, manufacturers of microscopes and other optical apparatus, died on June 16 at the age of seventy-eight years.

SCIENTIFIC EVENTS

PROPOSED MEMORIAL TO SIR HORACE DARWIN

THE letter given below, written by Dr. H. H. Dale, president of the Royal Society, was printed in the issue of June 3 of *The Times*, London.

The Royal Society has received from a generous donor, who wishes to remain anonymous, an offer of the sum of £2,000 to initiate a fund which it is desired to associate with the memory of the late Sir Horace Darwin, F.R.S., whose scientific vision and enterprise have had such important influence on the instrumental equipment of scientific research and its applications. Appropriately to that commemoration, the object named for the proposed fund is the provision of apparatus and materials for restoring the equipment of laboratories and institutions for scientific research in countries now occupied by our enemies. Such restoration must play a vital part in enabling allied countries, now so long the victims of aggression, to create anew their scientific and economic life.

The Royal Society, being in full sympathy with the objects thus indicated, has agreed to create the "Horace Darwin Fund" for their furtherance, and has accepted the contribution offered for its initiation. It can not be doubted that the allied countries which the enemy has occupied and despoiled will need such help on a very large scale; and the offer of it from this country would certainly strengthen the bonds of collaboration with our own scientific community, and contribute to the promotion and maintenance of the ultimate European settlement. The fund will be held by the Royal Society, for application to this purpose as soon and as rapidly as the liberation of the occupied countries, and the facilities for obtaining the required equipment, make effective action possible.

Contributions to the "Horace Darwin Fund" should be sent to the treasurer of the Royal Society, Burlington House, W.1, London.

THE RESEARCH COUNCIL OF RUTGERS UNIVERSITY

BASED upon the concept that a university exists to advance the frontiers of knowledge through study and research as well as to impart knowledge through instruction, Rutgers University has established a Research Council to strengthen the research program of the university. Its aims are to expand existing research programs; to encourage and facilitate the development of research in departments where none is now under way; to reduce to the minimum unnecessary duplication of effort; to encourage cooperative research between departments and between the university and organizations outside of the university; and to make available to scholars and the general public the results of research done in the university. The council will cooperate closely with deans, other administrative officers and department heads in strengthening the undergraduate and graduate programs of instruction and research. Attempts will be made to adjust the teaching load of those members of the fa

ulty whose research problems are considered worthy of support, as well as to secure for such professors occasional leaves of absence from teaching.

Another aspect of the council's work will be concerned with placing the research facilities of the university at the disposal of the State of New Jersey, its citizens and its industries to a greater extent than before. Contacts will be made with state agencies, industry, business and labor for the purpose of developing reciprocal arrangements providing mutual advantages to each.

The membership of the council includes:

Dr. William H. Cole, professor of physiology and chairman of the Bureau of Biological Research in the College of Arts and Sciences, who has been named director of the Research Council; Dr. Firman E. Bear, professor of agricultural chemistry, chairman of the soils department of the College of Agriculture and editor of *Soil Science*, who will serve as chairman of the council; Donald F. Cameron, associate professor of English in the College of Arts and Sciences and editor of the Rutgers University Press; Wallace S. Moreland, assistant to the president; James L. Potter, associate professor of electrical engineering in the College of Engineering; Dr. Walter C. Russell, professor of agricultural biochemistry and executive secretary of the Graduate Faculty; Dr. George P. Schmidt, professor of history in the New Jersey College for Women, and Dr. Peter van der Meulen, professor of physical chemistry and acting dean of the School of Chemistry.

There is also being organized an Advisory Board consisting of representatives from the university trustees, the State Board of Regents, Rutgers alumni, industry and the general public. The function of this board will be to survey annually the research facilities and accomplishments of the university and to make recommendations to the trustees concerning expansion and strengthening of the research program throughout the university.

Dr. Carroll Lane Fenton has been appointed editorial consultant to the director for the preparation of reports on the research facilities and on the work done to specific organizations as well as to the general public.

The Research Council is an outgrowth of the activities of a committee appointed by President Clothier in the summer of 1943 to study all matters related to research in the university. This committee studied the organization, purposes and procedures of similar agencies in other universities. It concluded that the interests of all concerned would best be served by organizing a council to cooperate with the deans and directors of the several schools and colleges in encouraging and strengthening research throughout the university.

In the fall of 1943 certain funds were placed at the disposal of the original committee and were used to support ten selected research projects submitted by various members of the staff. Some of the projects are closely concerned with the war effort, the details of which can not now be divulged, except to say that they have to do with a search for anti-malarial drugs, improved methods for analyzing cinchona bark and with acoustical investigation. Other projects are concerned with the physiological value of different proteins and their constituent amino acids in nutrition and in the prevention and treatment of disease; the structure of tomato seedlings and its bearing on successful transplantation; the preparation of material for the study and teaching of Latin-American Spanish; a geological survey of the State of New Jersey and the search for an improved method of determining the saponification number of fats.

For the next academic year, 1944–45, thirty-four applications for research funds were received from thirty different persons representing nineteen different departments of the university. The funds requested were two and one-half times the amount available for allocation. Fifteen grants were awarded for 1944–45, including a renewal of those mentioned above. Four of the awards carry leaves of absence from teaching for various parts of the academic year to be devoted exclusively to research.

LEGISLATION ON THE SCOPE OF THE U. S. PUBLIC HEALTH SERVICE

AN Associated Press dispatch in *The New York Times* states that on July 3 President Roosevelt approved legislation broadening the scope of the U. S. Public Health Service and in a statement commended the department for "its excellent record in protecting the health of the nation."

The act authorizes Federal grants for research by non-government institutions, larger appropriations to aid state public health work and the establishment of a national tuberculosis program. It provides commissions for public health nurses. The text of the statement is as follows:

The Public Health Service Act is an important step toward the goal of better national health. A constituent of the Federal Security Agency since 1939, the U. S. Public Health Service is one of the oldest Federal agencies—and one in which the people have great confidence because of its excellent record in protecting the health of the nation.

The act signed to-day gives authority to make grants-in-aid for research to public or private institutions for investigations in any field related to the public health. It authorizes increased appropriations for grants to the states for general public health work.

It strengthens the commissioned corps of the public health service for the enormous tasks of the war and the peace to come. Authority is granted to commission the nurses of the public health service, just as the nurses of the Army and Navy are commissioned.

It provides for the establishment of a national tuberculosis program in the public health service. Since adequate public health facilities must be organized on a nation-wide scale, it is proper that the Federal Government should exercise responsibility of leadership and assistance to the states.

In establishing a national program of war and post-war prevention, we shall be making as sound an investment as any government can make; the dividends are payable in human life and health.

THE NEW CIVIL PUBLIC HEALTH DIVISION IN THE OFFICE OF THE SURGEON GENERAL

THE program of the Civil Public Health Division of the Preventive Medicine Service which was established on January 1 has been strengthened by the assignment of Dr. Warren F. Draper, Deputy Surgeon General, U. S. Public Health Service, as chief of the Public Health Branch of the Civil Affairs Section at the Supreme Headquarters of the Allied Expeditionary Force. He will serve the U. S. Army as a Brigadier General.

The overall purpose of this new division in the Office of the Surgeon General is to develop plans pertaining to public health policy and practice in occupied and liberated territories. It is directed by Colonel Thomas B. Turner, who recently returned from an extensive tour of the European and Mediterranean theaters of operations where he made a study of public health conditions. Prior to his present assignment, Colonel Turner was director of the Venereal Disease Control Division. He is on leave to the U. S. Army from the School of Hygiene and Public Health of the Johns Hopkins University, where he is professor of bacteriology. For some time Colonel Turner was a staff member of the International Health Division of the Rockefeller Foundation.

The program already under way will integrate the public health activities of the Army overseas with that of other agencies in this field, including the U. S. Typhus Commission, the U. S. Navy, the U. S. Public Health Service, the United Nations Relief and Rehabilitation Administration and other national and international health organizations.

The Allied Armies will be called upon to assume a measure of responsibility for civilian public health in many areas, entailing supervision of or liaison with local public health officials and the provision of certain necessary medical supplies.

To accomplish this objective it will be necessary to commission from civil life a number of officers experienced in public health administration and in specialties such as epidemiology, nutrition and maternal and child hygiene.

A limited number of men who have had both general and special training in one or another of these special fields are still being sought for such assignments in the Far Eastern Area. They should not be over 50 years of age, and be physically qualified to perform at least limited service duties overseas. Previous military experience and knowledge of foreign languages is desirable but not essential. The men selected will undergo a course of training at the School of Military Government at Charlottesville, Va., and thereafter at the Civil Affairs Training School at Yale University. Instruction will include the theory and general principles of military government and liaison, and the language and background of certain Far Eastern areas. In addition provision will be made for training men in special phases of public health and certain medical specialties.

Further information may be obtained by addressing The Surgeon General, U. S. Army, Washington 25, D. C., Attention: Civil Public Health Division.

SCIENTIFIC NOTES AND NEWS

DR. WILLIAM HAMMOND WRIGHT, director emeritus and astronomer emeritus of the Lick Observatory, was awarded the honorary degree of doctor of laws by the University of California at its commencement on June 25.

THE honorary doctorate of science was conferred at the commencement of Harvard University on June 29 on Dr. Emory Leon Chaffee, Rumford professor of physics and director of the Cruft Memorial Laboratory of the university.

AT a recent meeting of the Indian Association for the Cultivation of Science, Professor A. V. Hill, biological secretary of the Royal Society, was awarded the Joykissen Mookerjee Gold Medal for 1944.

THE second James Ewing Award was presented in May to Dr. Edward R. Charlton, of Bronxville, N. Y., chairman of the cancer committee of Westchester County, as a token of recognition and commendation for "distinguished service to the people and to the medical profession of Westchester County contributing to the understanding and control of malignant disease."

PROFESSOR GEORGE P. BURNS, who has retired after serving for thirty-four years as head of the depart-

ment of botany of the University of Vermont, was honored by the members of his department at a banquet on July 1. He was given a bound edition of reprints of his published works from 1900–1944 as a token of their esteem and affection.

DR. ALFRED I. FOLSOM, of Dallas, Texas, was chosen president for 1945 at the St. Louis meeting of the American Urological Association. Dr. Clyde L. Deming, clinical professor of urology at the School of Medicine of Yale University, is president for 1944.

THE following officers have been elected for the year 1944–45 of the Association for Applied Psychology of New York City: *President,* Dr. W. H. Wulfeck; *Vice-president,* Dr. Edna E. Lamson; *Executive Council,* Dr. Anna S. Starr and Dr. Jeanne G. Gilbert. Dr. Gladys C. Schwesinger is *Secretary-Treasurer,* and Dr. Edith M. Achilles and Dr. John G. Peatman are members of the Executive Council.

DR. ALEXANDER N. WINCHELL, since 1908 professor of geology at the University of Wisconsin, retired on July 1.

DEAN JAMES FISHER retired on July 1 as head of the department of mathematics and physics of the Michigan College of Mining and Technology, after fifty years of teaching. He remains as dean, and will direct the new Extension Division.

PROFESSOR CARL L. A. SCHMIDT, chairman of the department of biochemistry and dean of the College of Pharmacy at San Francisco of the University of California, retired from administrative work on July 1. He will devote full time to his work at Berkeley.

THE REV. JAMES B. MACELWANE, S.J., has been appointed dean of the newly established Institute of Geophysical Technology at St. Louis University. The first classes will open on September 13.

DR. LOREN C. EISELEY, associate professor of sociology and anthropology at the University of Kansas, has been appointed professor and head of the department of sociology at Oberlin College. He will assume his new work on November 1. Dr. Eiseley has been associated with the University of Kansas since 1937.

DR. MARGARET A. OHLSON, associate professor of foods and nutrition at Iowa State College, has resigned to become head of the department of foods and nutrition at Michigan State College.

DR. FREDERICK C. LEONARD has been promoted from an associate professorship to a professorship of astronomy at the University of California at Los Angeles. For the past year he has been engaged in research at the Lick Observatory, where he will continue in residence until September. He then will return to the department of astronomy at Los Angeles.

DR. JOSEPH C. BOCK, who has been for twenty-six years professor of biochemistry and director of the department at the School of Medicine of Marquette University, will retire on July 31. He will be succeeded by Dr. Armand J. Quick, who for the past nine years has been associate professor of pharmacology.

THE following appointments have been made at the Long Island College of Medicine: Dr. William Dock, professor of medicine at the University of Southern California, professor of medicine; Dr. Edward Muntwyler, professor of experimental biochemistry at the School of Medicine of Western Reserve University, professor of chemistry and executive officer of the department, and Dr. James B. Hamilton, associate professor of anatomy at the School of Medicine of the University of Missouri, professor of anatomy and executive officer of the department. Dr. Fred L. More, director of the Division of Public Health Studies of the Commonwealth Fund, has been appointed to the newly established professorship of social and environmental medicine in the department of preventive medicine and community health.

GEORGE A. SLOAN, president of the Nutrition Foundation of New York, has been elected a special term member of the Corporation of the Massachusetts Institute of Technology. Dr. William J. Mixter, chief of the Neurological Service of the Massachusetts General Hospital, Boston, and Harold B. Harvey, president of the Harvey Metal Corporation of Chicago, have been elected alumni term members for five years.

DR. JOHN C. KRANTZ, JR., professor of pharmacology at the School of Medicine of the University of Maryland, has been appointed consultant pharmacologist and toxicologist to the Army Service Forces.

THE JOHN AND MARY R. MARKLE FOUNDATION has made an appropriation of $7,000 to the College of Medicine of Baylor University in support of the work on brain stem and related hypophysial and cerebellar functions of Dr. Allen D. Keller, professor of physiology and chairman of the department of physiology and pharmacology.

LORENZO R. PATINO, chief of the Department of Soil Conservation of the National Commission of Agriculture of Mexico, is making a three months visit to the United States as a guest of the U. S. Department of State. He is studying the work of the Soil Conservation Service of the U. S. Department of Agriculture.

DR. HORACE N. CORYELL, of the department of geology of Columbia University, is now in Florida where he will have an opportunity to make a complete examination of micro-faunas available as a result of deep

drilling in the Tertiary section of the southeast. The Geological Survey of Florida is cooperating in the undertaking.

PROFESSOR L. A. UNDERKOFLER, of the department of chemistry of Iowa State College, has been granted leave of absence to undertake research for the Farmers Cooperative Processing Corporation at Omaha on the production of mold-bran, a malt substitute needed by the Government.

THE Wilbur Wright Lecture of the Royal Aeronautical Society was delivered on May 26 by Sir Roy Fedden, the British aero-engine designer.

AT a meeting of the Division of Medicinal Chemistry of the American Chemical Society at the one hundred and eighth meeting of the society to be held in New York from September 11 to 15, a symposium has been arranged on sympathomimetic agents, compounds affecting the sympathetic nervous system. Those who will present papers include Dr. M. L. Tainter, the Winthrop Chemical Company; Dr. C. R. Scholz, Ciba Pharmaceutical Products, Inc.; Dr. Walter H. Hartung, University of Maryland, and Dr. Harry Gold, Cornell University Medical College. Dr. John H. Speer, of G. D. Searle and Company, chairman of the division, will preside at the sessions.

ANTICIPATING an unprecedented demand for postgraduate medical education upon the termination of war, particularly from physicians returning to civil life from service in the Armed Forces, and from civilian physicians from Central and South America, as well as from European countries released from Nazi control, the New York Academy of Medicine has established a Bureau of Medical Education. The function of this bureau will be to serve all physicians interested in furthering their medical education, but particularly the physicians returning from the war and the increasing numbers of foreign physicians who go to New York for postgraduate instruction and training. The bureau, organized by and operated under the supervision of the Committee on Medical Education of the New York Academy of Medicine, will render its services without charge. It plans to publish announcements of postgraduate medical courses, conducted by the universities and the hospitals of New York City. Thirty-three of the leading hospitals have been invited to collaborate in this work. A group of advisers representing the special fields of medical practice has been appointed to supervise its work.

THE Ministry of Agriculture of the Government of Cuba has authorized the establishment of a Marine Institute at the Castillo de la Punta in Havana. Its various sections will include an oceanographic museum, a library, an oceanographic station, instruction, industrial experimentation and publication.

ACCORDING to a report made by the United States Fish and Wildlife Service, more than 25,000,000 migratory waterfowl of various species used the Federal refuge areas during their southward journey in the fall of 1943. The figure is based upon their utilization of some ninety national wildlife refuges during the September–December migration period. Mallards ranked as the most numerous, with about 11,500,000, followed by pintails, with nearly 6,000,000, baldpates, 898,900, green-winged teals, 726,000, blue-winged teals, 600,000 and shovellers, 576,000.

THE recent formation of the British Shipbuilding Research Association has been followed by the formation of a research and development association to concentrate on particular forms of marine engineering—the application of steam and gas turbines to marine propulsion. The new association is to be called the Parsons and Marine Engineering Turbine Research and Development Association, and a representative council of eight directors has been appointed. *The Times*, London, reports that all shipbuilding and marine engineering firms who are manufacturers of marine turbines in the British shipbuilding centers are supporting this effort. The association intends to secure the maximum development of all types of propulsion by turbine for fast merchant ships, as well as for warships. It is to deal immediately with problems needing solution in the national interests, and bearing on the competitive position of the industry at home and in oversea trade. It will cooperate with the British Shipbuilding Research Association for the interchange of information and the prevention of overlapping. Nineteen British shipbuilding and marine engineering companies have joined the new body. Immediate steps are being taken to appoint a full-time research director for the association, together with an expert designing staff. The research director will be assisted by a consultative technical committee drawn from the principal technicians in the industry.

DISCUSSION

F_2 AND N^1-METHYLNICOTINAMIDE

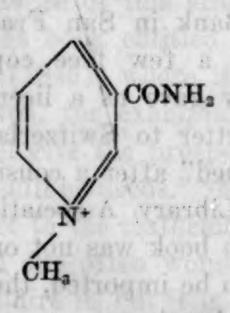
THE recent article by Najjar and White[1] in this journal calls for an elucidation of an obvious state of confusion concerning the nomenclature applied to the nicotinic acid metabolite occurring in the urine

[1] V. A. Najjar and V. White, SCIENCE, 99: 284, 1944.

which we had identified as N^1-methylnicotinamide.[2,3] Najjar and collaborators,[4,5] who, in fact, had discovered the fluorescent derivative of this metabolite obtained upon extraction into butanol from an alkaline aqueous phase, designated the fluorescent derivative as F_2[5]. However, in the same article[5] Najjar and Holt speak of "the failure of the dog to excrete F_2" and the article itself and a subsequent one[6] contain in their titles the wording "the excretion of specific fluorescent substances in the urine," and in both of these articles the authors speak of "the excretion of F_2 in the urine." It is obvious, therefore, that Najjar and collaborators employed the terms "fluorescent substance" and "F_2" to designate both the fluorescent compound observed in the butanol extracts from alkaline solutions and its precursor present in the urine.

In our publications[2,3] we presented proof of the identity of N^1-methylnicotinamide with the nicotinic acid metabolite and referred to it as F_2, following the precedent of the originators of this term. Neither of our articles dealt with the chemical structure of the compound produced from the metabolite (N^1-methylnicotinamide) by the action of alkali and butanol. Therefore, we consider the recent statement of Najjar and White calling our findings "an obvious error" on these grounds as entirely unjustifiable.

Until conclusive proof is adduced to the contrary, we feel convinced that the metabolite of nicotinic acid found in the urine is the cation of N^1-methylnicotinamide



which exists in the urine in equilibrium with the various anions according to the law of electroneutrality. There is no reason to suspect that the nature of the particular anion which may be associated with the cation is of any physiological significance. We utilized the well-established, classical[7] technic of isolating the base as a picrate, in the same manner in which it is used to isolate creatine and other bases from urine. There is little likelihood of any significant changes being produced in the structure of the metabolite in the formation of the picrate as implied by Najjar and White.

To avoid further confusion in this problem we wish to propose that only the fluorescent derivative in butanol obtained by extraction from strongly alkaline aqueous solutions be called F_2, and that its precursor, the physiological metabolite of nicotinic acid, be designated as the cation N^1-methylnicotinamide.

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Wm. A. Perlzweig
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2 J. W. Huff and W. A. Perlzweig, Science, 97: 538, 1943.

3 J. W. Huff and W. A. Perlzweig, *Jour. Biol. Chem.*, 150: 395, 1943.

4 V. A. Najjar and R. W. Wood, *Proc. Soc. Exp. Biol. and Med.*, 44: 386, 1940.

5 V. A. Najjar and L. E. Holt, Science, 93: 20, 1941.

6 V. A. Najjar and H. J. Stein, L. E. Holt and C. V. Kahler, *Jour. Clin. Invest.*, 21: 263, 1942.

7 G. Barger, "The Simpler Natural Bases." Chapter VIII. London, 1914.

* Nutrition Foundation Fellow.

RECENT RESEARCHES ON HEAVY WATER

There have been carried out some experiments on heavy water in Free China, since the war began in 1937. The temperature of the density maximum of heavy water[1] is measured with a 16 ml pycnometer made of quartz glass with a stem of 0.5 mm diameter. It is found to be 11.21 0.50°, in close agreement with the latest result of Stokland, Ronaess and Tronstad (1939). The measurement on the density of heavy water is further extended to the temperature range between its freezing point and 50°.[2] The differences between the densities of ordinary and heavy water show a maximum at 40°, which amounts to 0.10770 g/ml.

The molal freezing point lowering of D_2O with acetone as solute is observed as 2.00°, agreeing well with the calculated value 2.004°.[3] These values are lower than that calculated by Bartholome and Clusius (1935).

The solubilities of sodium chloride in 8 different mixtures of H_2O and D_2O are measured at 25°.[4] With an accuracy of 0.1 per cent. the relation $s_n = 6.145 - 0.334\,n$ holds, where s_n is the number of mols of NaCl dissolving in 55.51 mols of the aqueous mixture containing n mol fraction of D_2O. The solubility of NaCl in D_2O thus found is higher than that observed by Taylor, Caley and Eyring (1933). Furthermore, it is suggested that if such a linear relation holds for all soluble compounds, their solubilities can

1 Tsing-Lien Chang and Jen-Yuan Chien, *Jour. Chinese Chem. Soc.*, 8: 74, 1941.

2 Tsing-Lien Chang and Jen-Yuan Chien, *Jour. Am. Chem. Soc.*, 63: 1709, 1941.

3 Tsing-Lien Chang and Tsin-Chang Chu, *Sci. Rep. Nat. Tsing Hua Univ.*, A4, No. 4–6, 30th anniv. Commemoration Issue, delayed in press. A pamphlet entitled "Abstracts of Papers" thereof appeared in April, 1941, p. 7.

4 Tsing-Lien Chang and Tsin-Chang Chu, *J. physik. Chem.*, A184: 411, 1939.

be determined by linearly extrapolating the results for low D_2O concentrations.

One of the experiments on the chemical kinetics in D_2O is the velocity change of the reaction between hydrogen peroxide and hydriodic acid through the displacement of protium by deuterium atoms.[5] The time of the first 10 per cent. conversion of a solution of 0.01 n HI by H_2O_2 is measured in mixed aqueous media containing 0, 19, 50 and 73.7 ml D_2O at 20°. The reaction volume is 1 ml. The end point is indicated by the blue coloration of iodostarch after the iodine corresponding to the 10 per cent. conversion has been removed by 0.001 m $Na_2S_2O_3$ previously added. The results are extrapolated to 100 per cent. D_2O. It is concluded that the reaction $D_2O_2 + I^- — D_2O + IO^-$ in D_2O proceeds 0.60 times as fast as the corresponding reaction $H_2O_2 + I^- — H_2O + IO^-$ in H_2O.

Another similar experiment is the reduction of the permanganate ion by hydrogen peroxide in heavy water.[6] A solution of 0.001 *n* $KMnO_4$ in 0.05 *n* H_2SO_4 is reduced by H_2O_2 of various concentrations at 20°. Mixed aqueous media containing 0, 28.7, 47.8 and 79.6 mol per cent. D_2O are employed. Extrapolation of the results 100 per cent. D_2O leads to the conclusion that the autocatalysis of Mn^{++} ion proceeds more quickly in the presence of D_3O^+ in D_2O than in the presence of H_3O^+ in H_2O, the maximum increase of velocity being 50 per cent. Further, D_2O_2 reacts directly with MnO_4^- in D_2O with a rate equal to only 15 per cent. of that of H_2O_2 in H_2O. In the transitional region the velocity ratio drops down to a minimum of only 2.5 per cent., the reaction involving deuterium being slower.

Besides, heavy water is used to hydrolyze sodium and aluminum ethylate respectively.[7] The obtained ethyl alcohol-d, C_2H_5OD, purified by distillation in vacuum, boils at 78.8° and weighs 0.801 g/ml at 25°.

TSING-LIEN CHANG

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"THE PERMEABILITY OF LIVING CELLS"

WE have received a number of letters from interested people inquiring about the fate of the monograph which we wrote for the Protoplasma series, entitled "The Permeability of Living Cells." Since there seems to be some interest in the subject, we would appreciate this notation concerning the book.

In 1929 I was invited by the editors of the Protoplasma series, in collaboration with Mrs. Brooks, to write a volume on the "Permeability of Living Cells." This was finished in 1939, before we entered the war. Through various censorship delays at Bermuda and on ships, we were not able to get the final book out of Germany before we entered the war. We tried to get some copies imported through Stechert in New York for the various libraries and for others, but the Treasury Department refused a license. Dr. Joseph Needham, of Cambridge, England, interested himself in this, and through his efforts and those of Sir Henry Dale, the president of the Royal Society, and of Dr. A. V. Hill, the secretary of the Royal Society, the Ministry of Economic Warfare of Britain gave permission to have the book brought in through England. However, in spite of this, the U. S. Treasury still refused to grant us a license. Following this, various members of the National Research Council, the National Academy of Science, the American Physiological Society and the Office of Scientific Research and Development of this country have tried to get the book passed by the Treasury Department without success.

We made a personal visit to the Treasury Department in Washington and were given a "conference" by a Mr. Wechsler, formerly of New York. We were given a "dressing down" and told in a none too pleasant tone that we could be accused of "trading with the enemy."

After returning to the west coast again, we took the matter up with the Foreign Funds Division of the Federal Reserve Bank in San Francisco and asked permission to get a few free copies out through Switzerland. They gave us a license expiring in a month, and our letter to Switzerland was returned "Service discontinued" after a considerable time.

The American Library Association became interested, but since the book was not on the original list of foreign books to be imported, they said that nothing could be done by them.

Finally, through the efforts of various libraries and scientists who wanted the book, the matter was brought to the attention of the Alien Property Custodian of this country who asked us for a copy so that it could be reprinted!

The book is a critical analysis of various problems relating to the intake of salts, water, drugs, dyes in such things as cells, blood, serum, the various tissues and organs. It is without doubt a book which would facilitate the research being done in these various fields, being a critique and having over 3,000 references.

The present status is that we have the page proof with corrections, but this is evidently not satisfactory for filming, such as is the work of the Alien Property Custodian.

[5] Tsing-Lien Chang and Yu-Chih Wei, *Jour. Chinese Chem. Soc.*, 8: 138, 1940.

[6] Tsing-Lien Chang and Yu-Chih Wei, *Science Record*, I: 132, 1942.

[7] Tsing-Lien Chang and Yu-Chih Wei, *Sci. Rep. Nat. Tsing Hua Univ., loc. cit.*, p. 10.

It is interesting in this connection to reread the resolution passed by the American Association for the Advancement of Science[1] on "Intellectual Freedom":

> We regard the suppression of independent thought and of its free expression as a major crime against civilization itself. Yet oppression of this sort has been inflicted upon investigators, scholars, teachers and professional men in many ways, whether by governmental action, administrative coercion, . . .

S. C. BROOKS

UNIVERSITY OF CALIFORNIA

MATHEMATICS IN A NUTSHELL

ONE of the prominent features of the recent mathematical developments in our country is the rapid increase in very brief mathematical text-books which are largely intended for the use of students in the army and the navy. While these text-books may serve an actual need it should be remembered that they do not conform with the real nature of mathematics, which involves an unrestricted inquiry into the mathematical elements of our surroundings. Even the large text-book fails to give full freedom to the inquiring student, but it does not impose as many restrictions as the smaller text-book, where the arousing of interest along one line of thought is too rapidly followed by a change of subject.

Unfortunately, there is a tendency to imply that the small text-book contains all that is really important in regard to the subject under consideration. A somewhat extreme instance of this kind appears on page 418 of E. T. Bell's book entitled "The Development of Mathematics" (1940), where it is stated that "in permutation groups, for example, the first week of school algebra will give the prospective calculator all the manipulative skill he needs." Manipulative skill is often a great asset to the mathematician and after it has been acquired one often wonders why it took so much effort to acquire it, but it is unfortunate to understate the actual situations. Its acquisition usually requires persistent efforts on the part of the beginner, as has been experienced by many.

In view of the recent tendency to begin with a very brief text-book on a mathematical subject and to follow it later with a more advanced treatise it may be desirable to refer here to a subject where the opposite procedure was followed and to note some of the advantages which resulted therefrom. In 1870 there appeared under the title "Traité des substitutions" the first text-book on the theory of permutation groups. Its size of xviii + 667 large pages is the more remarkable in view of the fact that when it appeared much less was known about this subject than is known at the present time. Not only was it the first text-book on the subject of permutation groups, but it was also the first text-book on the subject of groups in general or any part thereof, and it therefore exhibits the modernness of this subject.

As late as 1926 the widely known mathematician, Felix Klein, said on page 338 of his "Entwicklung der Mathematik," volume I, that Camille Jordan traversed, in particular, all of algebraic geometry, number theory and function theory to find interesting examples of permutation groups which he then embodied in his text-book. The great wealth of material thus obtained is an important element of the history of group theory and explains to some extent why this subject gained so rapidly in prominence during the latter part of the nineteenth century when American mathematical contributions began to receive wide European recognition largely as a result of the foreign training of their authors.

Hence the extensive introductory text-book on a mathematical subject may also render very valuable service and one may wonder whether our modern tendency towards the very brief mathematical text-book for the beginner is a wise one. At any rate, it may be of interest to observe that a subject which gained so rapidly in the appreciation of the mathematical public as group theory did was introduced in a different way in recent times. It is possible that in the very brief mathematical text-book the student loses too much of outlook for the sake of avoiding difficulties and this outlook is often more inspiring than the simplicity which the very brief text-book usually provides. Many students are not averse to difficulties provided they are surmountable, and it seems worthwhile to make the effort to surmount them.

G. A. MILLER

UNIVERSITY OF ILLINOIS

SCIENTIFIC BOOKS

CITROLOGY

The Citrus Industry. Volume I. *History, Botany and Breeding.* Edited by HERBERT JOHN WEBBER and LEON DEXTER BATCHELOR. Pp. 1028. 233 illustrations. University of California Press. 1943.

DR. WEBBER, when teaching citriculture in the College of Agriculture at Berkeley, planned to write a one-volume text-book. For four years he worked on this, but his notes and manuscripts were lost in the big Berkeley fire in 1923. Two years later he was transferred to the Citrus Experiment Station at Riverside, and returning to his project of a book came

[1] *A.A.A.S. Bulletin*, Vol. 2, January, 1943.

to the conclusion that the subject should be treated in a larger way, and must be a cooperative project, with several authors. The growth of the work is well illustrated by the section on the "Botany of Citrus," written by W. T. Swingle. At first it seemed that 50 pages would be ample, but soon it was necessary to assign 75 pages, then 100. But finally the monograph of the citrus group (including the related genera) ran to 346 pages, and it is evident that future researches will considerably add to this.

In 1936 Dr. Webber retired from his administrative duties at the Citrus Experiment Station, becoming professor emeritus. But he kept his office and went on with his work on the great book. He now began to consider the possibility that he "might be called, and leave the work unfinished and in a muddle"; some provision must be made for continuity and completion, whatever happened. Dr. Batchelor, his successor as director of the station, agreed to become joint editor, and to contribute several chapters for the second volume. These details are given, not only because they are pertinent to the review but because they illustrate very well the growth and wise direction of a great project of prime importance for horticulture, botany and biological science in general. I do not know any other work treating a group of plants, of economic importance, so adequately. It should stand as a model for other books to be written in the coming centuries, dealing with many groups of plants. Three volumes will eventually be published, but the first, now issued, is complete in itself and will evidently be the one of most general interest and value. It should certainly be in the library of every university and botanical station, and should be studied by all those taking advanced botany. Indeed, it is of value to those who are not botanists, who wish to get new light on biological problems. It illustrates well the fact that when any subject is intensively studied, new ideas and facts will emerge, no matter how familiar the topic may have appeared to be.

The volume includes ten chapters and a good bibliography. W. T. Swingle writes on the "Botany of Citrus" and its wild relatives. H. J. Webber discusses the "History and Development of the Citrus Industry," "Plant Characteristics and Climatology" and "The Cultivated Varieties of Citrus." H. B. Frost has chapters on "Seed Reproduction," "Development of Gametes and Embryos," "Genetics and Breeding." E. T. Bartholomew and H. S. Reed write on "General Morphology, Histology and Physiology." H. D. Chapman and W. P. Kelley discuss the "Mineral Nutrition of Citrus." H. D. Shamel has a chapter on "Bud Variation and Bud Selection." It is of course impossible in a review to give any adequate account of the varied contents of all these chapters, and selections made by any reviewer are bound to follow the line of his personal interests or experience. Swingle divides the subfamily Aurantioideae (a zoologist would say Citrinae) into two tribes, the Clauseneae and the Citreae, the whole series including 33 genera, 203 species and 38 varieties. There are, however, numerous minor forms and innumerable hybrids. The hybrids are not given scientific names, but some are very complex and have striking characters. It is said of the citrangedins, which are derived from three genera and four species, being a cross between two hybrids, that if the parents were not known, the plants might be referred to a new genus and species. On page 355 is a diagram showing the intergeneric hybrids of *Citrus* and four other genera. It is open to any one to argue that these are not valid genera, since they cross so readily; but we have a similar case among the orchids, hybrids being produced between universally recognized genera. There is reason for thinking that some of the species admitted by Swingle may actually be of hybrid origin. A good example is the grapefruit, which takes the name *Citrus paradisi,* based on West Indian material by Macfadyen in 1830. This species apparently originated in the West Indies and has not been found native in the Old World. But since it is well known that *Citrus* and its immediate relatives are of Old World origin, the grapefruit must be derived from them. Swingle concludes: "It must be admitted that the true nature of the grapefruit is still unknown. It is to be hoped that the mystery of its origin can be settled by some of the newer methods now used in taxonomic research" (p. 419). The origin and first development of *Citrus* appears to have been on the mainland of southeastern Asia. Bartholomew (p. 695) shows how the fruits serve to relieve a water deficit in the leaves. He has an illustration of two branches cut off and allowed to remain in the laboratory for 48 hours. On one the fruits were allowed to remain, and these have become flaccid, while the leaves still remain normal. On the other, the fruits were detached, and remain firm, while the leaves have wilted and hang down. Years ago, I observed a similar phenomenon in peaches. I placed arsenical poison on some overripe peaches, to destroy the beetles which were attacking them. The fluids passed back into the tree, and several branches were killed. This property of the fruits, as reservoirs of moisture, suggests origin in a country having dry seasons. The fact that *Citrus* is in general intolerant of alkali may suggest origin in uplands.

The chapter on mineral requirements, well supported by illustrations, some of them in colors, shows

the importance of very small amounts of certain minerals, and the ill effects when they are present in excess. These reactions differ in different species; thus, the lemon is considerably more sensitive to boron injury than the orange. This kind of work, likely to be much extended in the future, will throw new light on the distribution of plants.

Dr. Webber's account of the "Cultivated Varieties of Citrus" contains much of general botanical interest. "Two seedlings among the variant types from a lot of approximately a thousand sour orange seedlings were found to lack odor. These two types, which in appearance of foliage and fruit seem mainly to resemble the sour orange, do not produce oil glands and oil. The foliage and the fruit rind when crushed give only the odor of fresh vegetable tissue, not the odor of the oils so characteristic of all members of the citrus family." Presumably this mutation is recessive and it would be possible to breed a distinct type of orange, representing what would be considered a distinct species, or even genus, if found wild. Then there are the blood oranges, which have long been known and are widely cultivated. "It is of interest to note that blood varieties grown in Florida rarely or never show the same intensity and general distribution of color in the fruits as those grown in California." The Washington navel orange, so important in California, is not a success in Florida. The Valencia orange, said to have come from Spain, is "more extensively grown than any other orange in California, Florida, Texas and South Africa, and is doubtless grown more widely and on a larger acreage than any other citrus variety in the world."

Discussions have arisen from time to time, concerning the independence of the scientific worker. He does not like to be regimented. The true solution of such difficulties is to be seen in the book before us. Webber, Swingle and the others did their work according to their best understanding, without external coercion; but no one can deny that for the best results it was necessary for them to cooperate and to have a broad purpose in common. Unquestionably a good deal of scientific work is relatively sterile because done in isolation, without relation to the work of others. Dr. Webber was the ideal man to organize such an enterprise as the all-round study of the citrus problem. His energy and tremendous enthusiasm and his readiness to cooperate with others made this thing possible. As far back as 1892, in Florida, he was associated with Swingle in the study of citrus diseases, and this led to Swingle's botanical work, which made over the whole subject of the citrus allies and added tremendously to our knowledge. Still another factor was the connection with the University of California, making it possible to produce the book in the most excellent and attractive form.

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SPECIAL ARTICLES

AEROSOLIZATION OF PENICILLIN SOLUTIONS[1]

The use of penicillin as an aerosol in the treatment of infections of the respiratory tract, particularly those caused by pneumococci, staphylococci and streptococci, appears to be feasible for several reasons. Penicillin is known to be bacteriostatic in extremely high dilutions, inhibiting the growth of hemolytic streptococci in quantities as low as .03 micrograms per cc.[2] In addition its activity should not be notably reduced by the organic detritus characteristic of suppurative and pneumonic conditions of the lungs. Since penicillin does not diffuse readily but is rapidly excreted the advantage of local application in all but generalized infections has been stressed by certain investigators.[3] Aerosol inhalational therapy, therefore, appears to be a logical addition to the existing techniques of administering penicillin.

The Long Island Biological Association has conducted a series of experiments to determine if penicillin aerosols can be produced and utilized successfully, using a standard glass nebulizer[4] operated continuously by compressed air. Sodium salt of penicillin was made available by the Committee on Chemotherapeutic and Other Agents of the National Research Council. With one exception we have maintained a concentration of 5,000 Oxford units per cc, using a M/50 phosphate buffer adjusted to a pH of 7. In a desire to conserve penicillin, experiments have not been conducted on an extensive scale.

It is known that the behavior of particulate substances in inspired air is a function of their size; effective penetration of the respiratory bronchioles and alveolae is best attained by small particles. Since rate of air flow through the nebulizing apparatus and physical properties of the solution are two factors influencing particle size, an analysis of buffered penicillin as utilized has been made. Photomicrographic records of penicillin aerosol were made with a modified ultramicroscope. Size determinations, calculated by Stokes Law, showed a distribution illustrated

[1] Aided by a grant from the Josiah Macy Jr. Foundation as part of a project for Chemical Warfare Service.

[2] M. H. Dawson *et al.*, *Ann. Int. Med.*, 19: 707, 1943.

[3] M. E. Florey and H. W. Florey, *Lancet*, 1: 387, 1943.

[4] De Vilbiss 40.

graphically in Fig. 1. The average particle radius was 0.54 μ, with a range of 0.24 μ to 1.18 μ.

Experience with other aerosols led to the conclusion that the penicillin aerosol was of sufficient physical stability and of a size favorable for therapeutic use. However, the chemical stability remained problematical and nothing was known about the fate of penicillin aerosol when inhaled. After preliminary investigation the following conclusions may be made:

(1) As utilized in the nebulizer, penicillin is not altered chemically by the air flow in a manner to

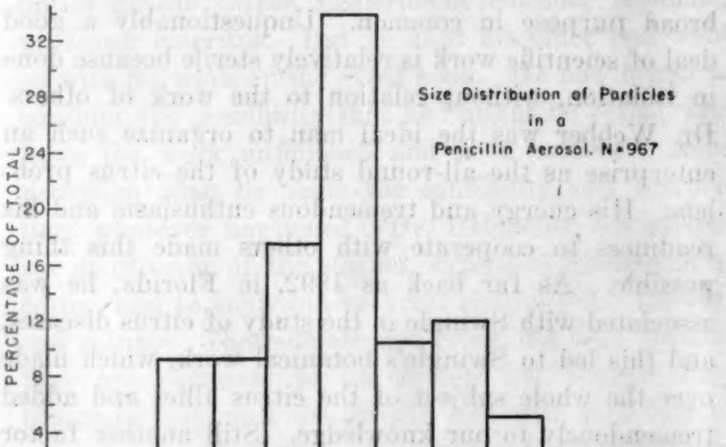

FIG. 1

reduce its potency as determined by the Oxford cup method. This was concluded after the passage of 125 liters of air at 5 liters per minute through a nebulizer containing 5 cc of penicillin solution. A sample from the nebulizer was then compared with a control and showed no loss of potency. An equivalent volume of pure oxygen likewise had no effect in reducing the potency of the solution.

(2) Penicillin forms an aerosol that may be recovered in phosphate buffer with no marked loss of activity. A known weight of penicillin was aerosolized into a suction flask and recovered by washing through phosphate buffer in Milligan gas-washing bottles. The same weight of material was diluted directly in phosphate buffer as a control. An activity loss of about 30 per cent. was observed in three trials. Since the experimental method does not enable one to distinguish between loss of potency and loss of material through inefficiency of the system, a different recovery apparatus was substituted using precooling with dry ice before washing. No significant loss of potency was then found.

(3) Penicillin aerosols penetrate into the lungs. An anesthetized rabbit was exposed to 100,000 units of penicillin aerosol in two hours, with the aid of a modified face mask. It was killed twenty minutes later by percussion. Tracheal perfusion of the lungs with 100 cc of buffer resulted in the recovery of a bacteriostatic substance not found in a control perfusion. Alveolar portions of lung were tested more directly by exposing four mice to 50,000 units of penicillin delivered continuously through a glass cage for one hour. Within the next hour all four animals had been killed, carefully bled, and the lobes of the lungs ground up in 20 cc of buffer and centrifuged. Slight bacteriostatic activity was shown by the experimental supernatant fluid and not by a control.

(4) Penicillin aerosols diffuse into the blood stream. Recovery of penicillin in the urine may be accepted as proof that it has been present in the blood. Two units per cc of penicillin were present in the urine of the experimental rabbit described above. As a further test a simple bottle carburetor with face mask attached was devised for human use, and 50,000 units were aerosolized continuously into the apparatus at 5.5 liters of air per minute and inhaled at 8 liters per minute, including carbureted air. Six per cent. of the total amount of penicillin aerosolized, and probably a larger proportion of the total amount inhaled, was recovered in the human urine within 12 hours.

Although the first lot of penicillin received had a distinct cheesy odor the present allotment, having a potency of 0.8 Oxford units per gamma, is virtually odorless and may be inhaled very comfortably. It should be possible to maintain the blood concentration at a more uniform level using the inhalational method than by intermittent intravenous or intramuscular injection. Between 50 and 80 per cent. of inhaled dust particles of the same size as the penicillin aerosol are retained in the human respiratory tract.[5] Since 0.1 cc of penicillin with a concentration of 250,000 units per cc has been aerosolized and inhaled there appears little doubt that large amounts of penicillin can be introduced by the aerosol method. Probably a saving of penicillin could be achieved by interrupted air flow or by rebreathing, but the final economy can be determined only by weighing therapeutic advantages, against the amount of material required by different techniques of administration. A combination of the nebulizer with an oxygen mask is easily made and compressed oxygen or air may be used to operate the nebulizer either separately or as an adjunct to other forms of inhalational therapy.

Using the oxygen mask-nebulizer combination with a rebreathing bag 3.2 per cent. of 25,000 units aerosolized into the mask was recovered in the urine during the first twelve hours after inhalation. A more economical technique is to place the nebulizer directly in the human subject's mouth for a brief inhalation (15 secs.) followed by breath holding (15 secs.), with a one-half minute interval before repetition. Admit-

[5] A. M. Van Wijh and H. S. Patterson, *Jour. Ind. Hyg. and Tox.*, 22: 31, 1940.

dly impractical without cooperation the method when roperly employed allows recovery of 60 per cent. of e aerosolized penicillin in the urine within twelve ours, comparing favorably with an average recovery f 60 per cent. after intravenous injection.[6]

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NDOCRINOLOGICAL ASPECTS OF AVIDIN FORMATION IN THE AVIAN OVIDUCT

WE have previously reported that avidin, the anti-iotin factor found in egg-white, is formed normally the oviduct of the hen and that avidin formation ay be induced experimentally by the administration f progesterone to immature birds pretreated with ilbestrol.[1,2] In the present report we wish to pre-nt data concerning (1) the ability of steroids other han progesterone to induce avidin production in pre-iously oestrogenized chicks and (2) the quantitative spects of the oestrogen-progesterone relationship in vidin formation.

Experimental methods, definition of the avidin unit nd control data on untreated and stilbestrol treated irds have been previously described.[2] In our earlier udies we have employed chicks approximately six eeks old. We have subsequently found that the day-ld chick responds equally well to the same treatment, dicating that no post-hatching reproductive develop-ent other than that occurring during the six-day ourse of stilbestrol conditioning is required for ex-erimental avidin induction. In the experiments re-orted here we have employed chicks 42 days old with e exception of the testosterone series in which day-ld chicks were used.

Both desoxycorticosterone acetate and testosterone ropionate induce avidin formation, desoxycortico-terone approximating progesterone in effectiveness Table 1). Testosterone propionate is effective at a mewhat higher daily dose (3.2 mgms), but its min-al effective dose was not determined.

This lack of specificity in avidin response to the veral steroids tested is in keeping with their recog-ized interchangeability in such other endocrinological actions as the maintenance of life in adrenalecto-mized animals and the precipitation of endometrial bleeding in the monkey.[3,4]

The comparable effectiveness of progesterone and desoxycorticosterone also raises the question of the gonadal or extragonadal origin and of the chemical identity of the steroid normally causing avidin formation in the laying hen.

Table 2 summarizes our data on the latent period required for the appearance of avidin following subcutaneous administration of progesterone with stilbestrol. By the end of two hours avidin is readily demonstrable in the oviduct and relatively high titres are reached within 4 to 8 hours. The latent period for progesterone induction of sexual receptivity in the guinea pig is from 3 to 9 hours, an interval quite comparable with that observed for avidin formation in the chick oviduct.[5]

Since the progestational reaction in mammalian endometria is facilitated by small supplementary dosages of oestrogen but is completely obliterated by relatively large dosages, it seemed desirable to determine the effect of increased oestrogen levels upon the avidin response.[6] The avidin titre is materially elevated when increased oestrogen is administered simul-

TABLE 1

AVIDIN TITRE OF OVIDUCTS OF 6-WEEK-OLD CHICKS, PRETREATED FOR 6 DAYS WITH 0.5 MG. STILBESTROL DAILY; SECONDARY INJECTIONS FOR 2 DAYS THEREAFTER, AUTOPSY CA. 24 HOURS LATER. ALL INJECTIONS SUBCUTANEOUSLY

Secondary injections		Oviducts tested	Avidin titres	
Stilbestrol	DOCA*		Average	Range
mg. daily	*mg. daily*	*No.*	*Units*	*Units*
None	0.05	3	0	....
"	0.20	4	0.13	0–0.25
"	0.80	4	0.48	0.33–0.60
"	3.20	7	0.56	0.50–0.60
0.5	0.80	4	0.46	0.33–0.50
"	3.20	4	1.89	1.40–2.50
5.0	0.80	4	1.95	2.50–3.30
"	3.20	3	1.28	0.33–2.50
	Progesterone *mg. daily*			
None	0.05	2	0	....
"	0.20	3	0.17	0–0.30
"	0.80	7	0.42	0.12–0.50
"	3.20	4	1.20	0.60–1.66
0.5	0.05	4	0	....
"	0.20	4	0.21	0–0.30
"	0.80	8	2.63	1.66–5.00
"	3.20	2	4.40	3.70–5.00
5.0	0.80	4	1.78	1.20–2.50
5.0	3.20	4	3.30	all 3.30
	Testosterone Propionate *mg. daily*			
None	3.20	3+	2.30	1.00–3.30
"	6.40	3+	0.70	0.50–1.00
"	12.80	3+	1.30	1.00–1.60

* DOCA = Desoxycorticosterone acetate.
\+ = day-old chicks.

[6] C. H. Rammelkamp and C. S. Keefer, *Jour. Clin. In-stigation*, 22: 425, 1943.

[1] R. M. Fraps, R. Hertz and W. H. Sebrell, *Proc. Soc. xp. Biol. and Med.*, 52: 140, 1943.

[2] R. Hertz, R. M. Fraps and W. H. Sebrell, *Proc. Soc. xp. Biol. and Med.*, 52: 142, 1943.

[3] R. Gaunt, W. O. Nelson and E. Loomis, *Proc. Soc. Exp. Biol. and Med.*, 39: 319, 1938.

[4] F. L. Hisaw, *Endocrinology*, 33: 39, 1943.

[5] E. W. Dempsey, R. Hertz and W. C. Young, *Am. Jour. Physiol.*, 116: 201, 1936.

[6] F. L. Hisaw and S. Leonard, *Am. Jour. Physiol.*, 92: 574, 1930.

taneously with progesterone. A representative series is presented in Table 1. The data indicate further

TABLE 2

AVIDIN TITRE OF OVIDUCTS OF STILBESTROL PRETREATED (0.5 MG. DAILY FOR 6–8 DAYS) CHICKS AUTOPSIED 2 TO 16 HOURS FOLLOWING SUBCUTANEOUS INJECTION OF PROGESTERONE (+ STILBESTROL). FIGURES IN PARENTHESES INDICATE RANGE OF TITRES

Injection to autopsy	Secondary injection: Progesterone 0.4 mg, Stilbestrol 1.0 mg		Secondary injection: Progesterone 1.6 mg, Stilbestrol 4.0 mg	
hours	*oviducts*	*avidin, units*	*oviducts*	*avidin, units*
2	3	0.13 (0–0.25)	3	0.32 (0.20–0.50)
3	3	0.44 (0.33–0.50)	3	0.24 (0.20–0.33)
4	7	0.71 (0.20–1.60)	3	0.26 (0.20–0.33)
8	5	0.55 (0–1.00)	3	1.18 (0.33–2.00)
16	5	0.40 (0.33–0.50)	3	1.47 (1.00–2.00)

that the avidin titre increases with increasing progesterone over at least a 16-fold range, whether stilbestrol is administered simultaneously or not. Moreover, similar reciprocal quantitative relations are observed for desoxycorticosterone as for progesterone. Thus there is no evidence of the decisive antagonism between oestrogen and progesterone which is observed in the progestational response of the mammalian uterus.

These quantitative and qualitative features of the endocrine control of avidin formation lend additional support to the possibility that avidin may play a role in the physiology of reproduction.

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ON THE VITAMIN B_c CONJUGATE IN YEAST

THE isolation of crystalline vitamin B_C from liver and its identity with an *L. casei* growth factor has been reported.[1] We have found that yeast and certain yeast extracts are highly active in vitamin B_C activity as measured in the anemic chick but they have little potency in stimulating the growth of *L. casei*. Only about 2 to 5 per cent. of the chick antianemia activity can be accounted for in terms of microbiological growth effect on either *L. casei* or *S. lactis*. The methods used for isolating vitamin B_C from liver failed when applied to yeast. Using the chick curative assay procedure[2] and later a preventive assay procedure[3] we have concentrated the chick antianemia factor in yeast. It is seemingly non-protein in nature, since it is dialyzable through Cellophane No. 300, and is not precipitated by heat in acid solution, by saturated ammonium sulfate at pH levels between 3 and 7 nor by trichloracetic acid.

Concentrates of the chick antianemia factor which are essentially inert in stimulating the growth of *L. casei* become highly active in microbiological growth effect following enzymatic digestion. Procedures developed earlier for the isolation of vitamin B_C from liver when applied to such digests yielded a pure crystalline compound which had the same growth stimulating activity on *L. casei* and *S. lactis* as vitamin B_C from liver. It also had a comparable effect on the blood picture and growth of the chick. The products from the two sources have the same color, crystalline appearance and solubilities. They behave similarly on heating, slowly discoloring and charring from about 250° C. without melting. The compounds from liver and yeast were found to be crystallographically identical[4] and to have identical ultraviolet absorption spectra.[5] They analyzed as follows: Yeast compound C 52.44, 52.51; H 4.37, 4.41; N 20.3, 20.2; liver compound, C 52.44, 52.46; H 4.28, 4.49; N 19.8, 19.6. We conclude that the compound isolated from yeast is identical with vitamin B_C from liver.

Stokstad[7] on the other hand has reported the preparation of an *L. casei* factor from liver and a different *L. casei* factor from yeast. He believes the one from liver to be identical with vitamin B_C. More recently Hutchings *et al.*[8] have presented evidence for the existence of at least three *L. casei* factors or "folic acids." The source of the third one is not stated.

The fact that our crystalline product from yeast, a plant source, is identical with crystalline vitamin B_C from liver increases the probability that the "folic acid" concentrates prepared from spinach by Mitchell, Snell and Williams[9] contained variable amounts of vitamin B_C.

Our results demonstrate that the chick antianemia activity in yeast extract is due to the presence of vitamin B_C held almost entirely in the form of a rela

[1] J. J. Pfiffner, S. B. Binkley, E. S. Bloom, R. A. Brown, O. D. Bird, A. D. Emmett, A. G. Hogan and B. L. O'Dell, SCIENCE, 97: 404, 1943.

[2] B. L. O'Dell and A. G. Hogan, *Jour. Biol. Chem.*, 149: 323, 1943.

[3] C. J. Campbell, R. A. Brown and A. D. Emmett, *Jour. Biol. Chem.*, 152: 483, 1944.

[4] Observations by Professor C. B. Slawson, of the University of Michigan.

[5] E. S. Bloom, J. M. Vandenbelt, S. B. Binkley, B. L. O'Dell and J. J. Pfiffner. In press.

[6] Analytical results reported previously (SCIENCE, 97: 404, 1943) were obtained on a sample since found to be incompletely dried.

[7] E. L. R. Stokstad, *Jour. Biol. Chem.*, 149: 573, 1943.

[8] B. L. Hutchings, E. L. R. Stokstad, N. Bohonos, J. Oleson and L. W. McElroy, Abst. of 107th meeting Am. Chem. Soc., Cleveland, Ohio, April 3–7, p. 1A (1944).

[9] H. K. Mitchell, E. E. Snell and R. J. Williams, *Jour. Am. Chem. Soc.*, 63: 2284, 1941; 66: 267, 271, 274, 1944.

vely simple conjugate. It is common knowledge at many of the B vitamins occur in a "bound" form, hat is, bound to macro-molecular substances, but the ccurrence of a simple non-protein conjugate of vitain B_C has not been previously recognized. It seemed esirable to call attention to these results at this time nce they bear on the interpretation of nutritional ata involving growth of the chick, especially with espect to the chemical identification of other chick actors, such as Factor U,[10] the alcohol precipitate actor[11] and vitamins B_{10} and B_{11}.[12] Any one or all our of these factors may be identical with vitamin B_C onjugate.[13] Work is in progress on the chemical nature of the non-vitamin B_C portion of the conjugate molecule.

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R. A. Brown
D. G. Calkins
C. J. Campbell
A. D. Emmett
J. J. Pfiffner

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[10] E. L. R. Stokstad and P. D. V. Manning, *Jour. Biol. Chem.*, 125: 687, 1938; E. L. R. Stokstad, P. D. V. Manning and R. E. Rogers, *Jour. Biol. Chem.*, 132: 463, 1940.
[11] A. E. Schumacher, C. F. Houser and L. C. Norris, *Jour. Biol. Chem.*, 135: 313, 1940.
[12] G. M. Briggs, Jr., T. D. Luckey, C. A. Elvehjem and E. B. Hart, *Jour. Biol. Chem.*, 148: 163, 1943; Abst. of 107th meeting, Am. Chem. Soc., Cleveland, Ohio, April -7, p. 15B (1944).
[13] We have demonstrated the occurrence of vitamin B_c conjugate in certain liver extracts.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A FIVE-MINUTE METHOD FOR STAINING FECAL SMEARS

Using the following technique, it is possible to preare permanent hematoxylin stained slides of fecal mears in five minutes or less.

olution I (mordant-fixative)
formalin, 10 per cent. by volume .... 3 parts
glacial acetic acid .... 1 part
ferric ammonium sulfate .... 3 per cent.
(3 grams of the iron alum per 100 cc formol-acid mix)
olution II (stain)
0.5 per cent. hematoxylin (aqueous)
olution III (dehydrating and clearing)
dioxane
olution IV (dehydrating and clearing)
dioxane
olution V (clearing)
dioxane and toluol, half and half.

Procedure

(1) With a brush, make a very thin smear of the ecal material to be examined.

(2) Cover smear immediately with a few drops of olution I. Pass slide through a bunsen or alcohol ame a few times or until the fixative begins to steam. e ready to add more solution to the slide if necessary prevent drying. Quickly pour off the mordantxative.

(3) Immediately add several drops of solution II. gain pass the slide through the flame one or two imes, tilting it back and forth. Be sure that enough tain is put on to keep the smear covered. The fecal aterial should become a dark purple color in three or our seconds.

(4) Place the slide at once into a coplin jar of water and wash under running tap water for one minute.

(5) Lay the slide on blotting paper and remove excess water on the smear side with filter paper or cleansing tissue. Quickly transfer the slide to solution III.

(6) Put the slide into the second jar of dioxane for at least one minute.

(7) Transfer the slide to solution V for a minimum of thirty seconds.

(8) Mount in clarite.

Comments

The results obtained are much superior to those from the iodine technique for rapid fecal examination and compare favorably with the usual speed-up process using warm solutions, which takes about an hour and a half. The material is not as satisfactory as that prepared by the standard longer methods for critical cytological work. Even so, this technique is well adapted for a rapid survey of intestinal protozoa of animals or of man. Leaving the stain on for an extra second will overstain the cells but will make cilia, undulating membranes and flagella stand out clearly. Careful staining will adequately show all chromatin particles. The length of time of staining depends on the size of the flame used and the temperature of the slide. In some cases, the slide is hot enough after the mordant-fixative treatment to require no additional heating with the stain. Care must be taken, however, not to overstain the smear. If it does become overstained, it can be rapidly destained by rinsing in water and then adding a few drops of cold solution I. Stop the destaining process and blue the smear by washing in tap water. Dehydration and clearing are aided by slight agitation of the slide while

it is in the dioxanes. A slide holder or clothespin should be used to hold the slide during the first two steps. Insufficient time has elapsed to determine whether or not the stain will fade after only one minute of washing. The dioxane solutions should be kept in tightly stoppered bottles when not in use and should be renewed often if used frequently.

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A PRESSURE-CONTROLLED ELECTRIC CIRCUIT

THIS circuit consists of two ordinary bell-ringing transformers and what may be called an electrolytic

FIG. 1.

switch actuated by pressure. It is connected to the ordinary 60-cycle lighting circuit, and the output power is sufficient to light a neon glow lamp or to actuate a sensitive relay.

The two transformers are connected together so that in effect they constitute a single one-to-one transformer. The power output is from the high-voltage winding of the second of the pair, the low-voltage windings of the two being simply connected together as shown in the diagram. The purpose of the transformers is to permit grounding of any selected part of the power output circuit, and to provide a safe limitation on the power that might accidentally be obtained. The power is so limited that no flash can be obtained, and no shock more than a nip of the finger, by inadvertence or accident of any degree.

The electrolytic switch may be of any of widely various forms. The diagram shows one designed to be actuated by the least fluid displacement. A small metallic rod extends down into a short glass tube. A wire is fixed centrally in the bottom of the rod, extending down to make contact with the electrolyte in the tube. This glass tube is cemented into a metallic sleeve or tube which connects below to the water vessel or source of pressure. One electric connection is made to this metallic tube, the other to the rod above. The action of the switch will be readily understood. What calls for remark is the fact that this arrangement is effective, that it works out advantageously in practice. Ordinary tap water is sufficiently conductive to afford a clear and definite signal even with a 3-watt neon glow lamp. It takes very little to increase the conductivity of the water to the point where a one-watt lamp is lighted substantially as it is when connected directly in the lighting circuit. There is no electrode trouble, because the current is alternating and small.

A striking sensitivity is obtained by connecting a length of rubber tubing to the switch, pinching off the lower end and carefully adjusting the water level and the upper electrode. The adjustment can readily be made so that the circuit is closed by a very slight movement of the rubber tubing or by a very slight pressure.

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